REMARKS

Claims 1-8, 12-19 and 23-29 are pending in the present application, claims 9-11, 2-22 and 30-32 having been cancelled herein. The Office Action and cited references have been considered. Favorable reconsideration is respectfully requested.

The claims have been amended as follows:

The language of Claims 1, 13 and 24 has been amended to include the limitation, according to which each radiating element is capable of transmitting and/or receiving electromagnetic waves of the predefined polarization with a phase center located at a predefined position. Support for the amendments carried out in Claims 1, 13 and 24 can be found e.g. in pp. 7, third par., pp. 9, second par., and pp. 12, first par. of the present application.

Additional amendments in Claims 1, 13 and 24 have been made for clarification: the wording "of said radiating ...lower face" which described the "pair", has been omitted, thereby enhancing clarity of the claims.

Claims 9-11, 20-22 and 30-32 have been canceled without prejudice.

Claim 15 has been amended to depend on Claim 13.

No amendment has been made to original Claims 2-8, 12, 14, 16-19, 23 and 25-29.

The following rejections and remarks have been made by the Examiner:

1. The rejection of Claims 1-5, 9-10, 12-16, 20-21, 23-26, 30-31 under 35 U.S.C 102(e) as being anticipated by Yoon *et al* (US Patent No. 6,844,851);

2. The rejection of Claims 6, 7, 17-19, 27 and 28 under 35 U.S.C 103(a) as being unpatentable over Yoon in view of Tsai *et al* (US Patent No. 6,424,311);

3. The rejection of Claims 11, 22 and 32 under 35 U.S.C 103(a) as being unpatentable over Yoon in view of Tsai and further in view of Audenaerde *et al* (US Patent No. 6,166,702);

4. Remarks regarding Claims 8 and 29.

The subject matter of Claims 8 and 29 is allowed.

Before turning to discuss the Examiner's contentions on the merits, there is provided a brief overview of Yoon and Tsai and certain non limiting embodiments of the invention, in order to better understand the distinctions between Yoon and Tsai and the claimed invention:

Certain non limiting embodiments of the invention:

The present invention concerns planar (or flat-plate) and conformal antennas for high frequency microwave transmission, used for e.g. radio broadcasting, mobile communication and satellite communication. According to certain embodiments of the present invention, there is provided a microwave antenna for transmitting and/or receiving electromagnetic waves of at least one predefined frequency and a predefined polarization, with high gain and good axial ratio.

According to certain embodiments of the invention, the antenna comprises a support with upper and lower faces. On the upper and lower faces there are disposed substantially identical upper and lower radiating elements, constituting a pair of radiating elements. Each radiating element is capable of transmitting and/or receiving electromagnetic waves of the predefined polarization with a phase center located at a predefined position. In each pair of radiating elements, the phase center of the lower radiating element substantially coincides with the phase center of the upper radiating element. The resultant gain is high - up to 3dB, due to the

constructive superposition of the upper and lower radiating elements.

According to certain embodiments of the present invention, the element disposed on either the upper face or the lower face is a radiating element, that is capable of transmitting and/or receiving electromagnetic waves of at least one predefined frequency and a predefined polarization with a phase center located at a predefined position. This limitation relates to the design of a single antenna element and is hereinafter denoted as the "radiating element on one face" limitation. For example, upon feeding e.g. a single radiating element disposed onto the upper face with electromagnetic radiation of a circular polarization, this element will irradiate electromagnetic radiation of a circular polarization. Note that a dipole having one branch on the upper face and the other branch on the lower face is excluded by the "radiating element on one face" limitation.

As with any radiating element, the radiating element of the invention disposed on the upper or the lower face has a phase center. According to certain embodiments of the present invention, in each pair of radiating elements, the phase center of the lower radiating element substantially coincides with the phase center of the upper radiating element. This

limitation is hereinafter denoted as the limitation of "coinciding phase centers". This limitation relates to the design of the pair of radiating elements, one positioned of the upper face and one on the lower face of the supporting plate. Put differently, the limitation of "coinciding phase centers" relates to the relative disposition of the radiating elements positioned on the different faces of the same supporting plate.

Yoon (US Patent No. 6,844,851, previously US Patent application No. 20030218571 cited by the Applicant):

Yoon disclosed an antenna having two microstrip plates. On each plate there are disposed dipole radiating elements. Each dipole has a curved shape and is formed with a branch positioned on one face of a plate and another corresponding branch positioned on the other face of the same plate (see at col. 2, lines 40-54 and Fig. 3). Yoon teaches forming the dipoles in a curved shape. The polarization vectors of the dipoles disposed on the different plates are orthogonal to each other. When two substantially identical microstrip plates, each bearing curved-shape dipoles, are adjacent to each other, the resultant mutual coupling is relatively low and therefore the overall gain is increased

(see col. 2, line 63). The overall polarization of the double-plate antenna is determined by the correlation of the polarizations of the dipoles of each plate. Therefore, Yoon teaches a dual-polarization antenna array (see col. 5, lines 51-51).

In Yoon, the radiating elements are dipoles and therefore the term "radiating elements" in Yoon refers to the dipoles, that is to the combination of conductor elements - the dipole branches, positioned onto the first and second surfaces of a single plate. Indeed, Yoon sometimes refers to the dipole branches as "radiating elements" (e.g. elements 310 and 350a positioned onto the first and second faces of plate 210, shown in Fig. 3), however it is clear that a stand-alone dipole branch positioned on a certain surface of the plate cannot function as an antenna, and the electromagnetic radiation irradiated from the dipole, is generated by the combination of electromagnetic radiation fed into both branches of a dipole. See also in col. 3, lines 58-65, **where Yoon determines the radiating element as comprising a pair of branches forming a 45° angle with a stem and corresponding to a symmetric dipole. One branch is positioned on the first face and the other on the second face of a plate. The antenna according to Yoon is comprised of such symmetric dipoles disposed on first and second plates.**

From the discussion above, it is clear that the teaching of Yoon is limited to an antenna having two plates, each bearing curved dipole radiating elements of orthogonal polarization. Yoon does not teach a radiating element positioned on one face of a single plate. Nor does Yoon teach an arrangement of a paired radiating elements positioned on different faces of a single plate and having their phase centers coinciding.

Furthermore: Yoon teaches to provide a pair of dipoles - one positioned on the first plate (the "first dipole") and one on the second plate (the "second dipole") - with orthogonal polarization; Yoon also teaches to design each dipole in a curved shape that allows arranging more radiating elements over the same antenna area. Although not directly discussed in Yoon, it should be clear to anyone versed in the art, that due to the symmetry between the first and second dipoles, the phase centers of the first dipole and the second dipole do not coincide. It should also be clear that if the phase centers of the first and second curved dipoles would be arranged to coincide, the coupling between the first and second dipoles would be increased and the overall performance of the dual-polarization antenna would be decreased.

Tsai (US Patent No. 6,424,311)

Tsai discloses a dipole antenna having dual linear polarization, for selecting an antenna polarization plane. This is achieved by two identical dipole antenna elements arranged perpendicularly to each other and positioned onto a support plate (elements 1 and 2 in Figs. 1 and 2). Each dipole antenna element comprises first and second dipole arms (elements 11 and 12), each arm having a T-shape (e.g. first and second arm sections 112 and 113), and a feed point located on the second arm section 112. One T-shape element is positioned on a first face of the support plate and the second element is positioned on the second face of the plate.

The dipole elements 1, 2 independently radiate a horizontally linearly polarized wave and a vertically linearly polarized wave, and the stronger polarization plane is selected (col. 3, lines 25-37). Maximum radiation efficiency is achieved by providing a dual-linear polarization antenna and selecting the strongest polarization mode; minimizing interference between the dipole T-shape arms positioned on different faces of the supporting plates; and by allowing positioning more dipole elements over the same area (col. 2, lines 20-31).

Tsai teaches dipole antenna elements having T-shape dipole arms. This is different from the L-shape radiating element of the claimed invention: the T-shape element of Tsai forms part of a dipole, wherein the L-shape element of the present invention is an antennal element by its own.

Furthermore: The dipole disclosed by Tsai (element 1 in Figs. 1 and 2) is symmetrical regarding an axis parallel to the radiating arm sections (elements 113, 123) - as can be seen in Fig. 2. The dipole antenna presented by Tsai is limited to linear polarization. The phase centers of the adjacent dipole antennas do not coincide. In addition, Tsai teaches to selectively feed one of the adjacent dipole antenna elements at a time (col. 3, lines 25-37).

Having generally discussed certain embodiments of the invention, Yoon and Tsai, there follows a discussion of the rejections raised by the Examiner:

1. The rejection of Claims 1-5, 9-10, 12, 13-16, 20-21, 23-26, 30-31 under 35 U.S.C 102(e) as being anticipated by Yoon *et al*

Following the above discussion of the claimed invention and Yoon, it should be clear that the claimed invention is not anticipated by Yoon:

Claims 1-5:

Yoon does not teach a support with upper and lower faces, over which are disposed radiating elements: according to Yoon, the radiating elements - that is the basic structure forming a single antenna element - are dipoles having a first branch positioned on the first face, and a second branch positioned on the second face of the same plate. Therefore, electromagnetic radiation having a predefined polarization - linear polarization - is generated by feeding the two dipole branches positioned on both faces of the plate.

In contrast to Yoon, according to the claimed invention, the basic structure forming a single radiating element is disposed on one face of the support plate, constituting an antenna having a phase center and capable of transmitting and/or receiving electromagnetic radiation having a predefined polarization (e.g. circular polarization, linear polarization). This is the "radiating element on one face" limitation recited in Claim 1. More specifically, Yoon does not teach a radiating element capable of transmitting and/or receiving electromagnetic radiation having a circular polarization (recited in Claim 4). Furthermore, Yoon does not teach a radiating element positioned onto one support face and having a bend-shape (recited in Claim 5).

Furthermore, Yoon does not teach having the phase center of the lower radiating element in a pair of radiating elements, substantially coinciding with the phase center of the upper radiating element. This is the "phase center coinciding" limitation recited in Claim 1: if we consider the teaching of Yoon for a single plate structure, then the elements on the upper and lower faces together form a dipole and as such, do not have a phase center when considered alone. If we consider the teachings of Yoon for a double-plate structure, the phase centers of the dipole located on one plate do not coincide with the phase center of the dipole located on the second plate. Furthermore: if the two dipoles would be adjacent such that their phase center will coincide, then the overall performance of the pair of dipoles would be decreased due to interference between the dipoles (PLEASE CONFIRM).

Claims 13-16 and 23:

Claims 13-16 relate to certain embodiments of the invention, some of which are illustrated in Figs. 2, 4A-4D. Claim 13 includes the **"radiating element on one face"** and **"coinciding phase centers "** limitations recited in Claim 1, as well as additional limitations. Therefore, the reasoning

stated above with reference to Claim 1 *mutatis mutandis* applies to Claim 13. Claims 14-16 depend upon Claim 13.

Claims 24-26:

Claim 24 is a method claim relating to certain embodiments of the invention. Claim 24 includes the **"radiating element on one face"** and **"coinciding phase centers"** limitations recited in Claim 1 (with the appropriate changes, as Claim 1 is a system claim), as well as additional limitations. Therefore, the reasoning stated above with reference to Claim 1 *mutatis mutandis* applies to Claim 24. Claims 25-26 depend upon Claim 24.

In light of the foregoing discussion, the Applicant requests that the rejection of Claims 1-5, 12, 13-16, 23 and 24-26 under 35 U.S.C 102(e) be reconsidered and withdrawn.

2. The rejection of Claims 6, 7, 17-19, 27 and 28 under 35 U.S.C 103(a) as being unpatentable over Yoon in view of Tsai

Claims 6, 7, 17-19, 27 and 28 all relate to certain embodiments of the invention in which the shape of the radiating element is an L-shape. Claims 6, 7, 17-19, 27 and 28

relate to certain embodiments of the invention wherein the predefined polarization is circular polarization, and wherein each of the radiating elements is capable of radiating electromagnetic waves of a circular polarization (this limitation is recited in Claims 4, 16 and 25, on which Claims 6, 7, 17-19, 27 and 28 depend, in turn). In contrast, the teachings of Yoon and Tsai are limited to a radiating element designed for linear polarization only.

In light of the discussion above regarding Yoon, Tsai and the rejection of Claim 1 over Yoon, it should be clear that Claims 6, 7, 17-19, 27 and 28 are patentable over Yoon in view of Tsai. Therefore the Applicant requests that the rejection of Claims 6, 7, 17-19, 27 and 28 under 35 U.S.C 103(a) be reconsidered and withdrawn.

3. The rejection of Claims 11, 22 and 32 under 35 U.S.C 103(a) as being unpatentable over Yoon in view of Tsai and further in view of Audenaerde *et al* (US Patent No. 6,166,702);

It is believed that Claims 11, 22 and 32 are patentable over Yoon in view of Tsai and further in view of Audenaerde. However, Claims 9-11, 20-22 and 30-32 are now cancelled without prejudice, and therefore there is no need to respond to the Examiner's remarks at this stage.

The same applies to the Examiner's remarks regarding Claims 9-10, 20-21 and 30-31, whichhave also been cancelled.

4. Remarks regarding Claims 8 and 29:

The subject matter of Claims 8 and 29 is considered as allowable subject matter. Claims 8 and 29 are objected to as being dependent upon a rejected base claim. Following the discussion above, the Applicant requests that the objection be reconsidered and withdrawn.

The Applicant believes that the amendments carried out in the claims, as well as inclusion of the above remarks, should now place the application in a condition for allowance.

In view of the above amendments and remarks, Applicant respectfully requests reconsideration and withdrawal of the outstanding rejections of record. Applicant submits that the application is in condition for allowance and early notice to this effect is most earnestly solicited.

If the Examiner has any questions he is invited to contact the undersigned at 202-628-5197.

Respectfully submitted,

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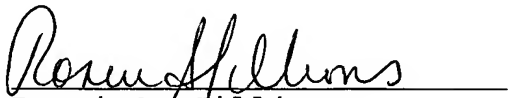
By 
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